Amendments to the claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of claims:

Claim 1 (currently amended): A graphic processing apparatus having a Z-buffer memory storing a Z value representing a depth of a display object when seen from a visual point per pixel and a pixel memory storing color data on each pixel for creating an image of a shadowed three-dimensional object having a shadow produced by obstructing a ray of light from a light source by the three-dimensional object, comprising:

a visual-point coordinate conversion processing section for upon input of graphic data on normal polygons constituting each object including the three-dimensional object and on shadow polygons constituting a shadow volume that defines a shadow space produced by obstructing the ray of light from the light source by the three-dimensional object, converting the graphic data to visual-point coordinates including x-coordinates and y-coordinates and depth values, and outputting the obtained visual-point coordinates and depth values in a state of being sorted into those of front-facing shadow polygons that face front, those of back-facing shadow polygons that face back when seen from the visual point, and those of the normal polygons; and

a hidden surface removal and shadowing processing section for obtaining a coordinate region that is positioned behind the front-facing shadow polygons and in front of the back-facing shadow polygons when seen from the visual point based on the visual-point coordinates, the depth values and the Z-buffer memory after hidden surface removal processing by Z-buffer method is performed on the normal polygons, and updating color data on pixels in the pixel memory corresponding to the obtained coordinate region to shadow color data,

processing of the back-facing shadow polygons includes obtaining the depth value of each pixel of the back-facing shadow polygons, ~~comparing~~ and performing a Z test in which the depth value is compared with a corresponding Z value obtained from the Z-buffer memory, and if the depth value is equal to or greater than the corresponding Z value, then the pixel is processed as belonging to a Z-test failed region of the back-facing shadow polygon, ~~and~~

processing of the front-facing shadow polygons includes obtaining the depth value of each pixel of the front-facing shadow polygons, ~~comparing~~ and performing a Z test in which the depth value is compared with a corresponding Z value obtained from the Z-buffer memory, and if the depth value is smaller than the corresponding Z value, then the pixel is processed as belonging to a Z-test passed region of the front-facing shadow polygon,

obtaining an intersection of the Z-test failed region of the back-facing shadow polygon and the Z-test passed region of the front-facing shadow polygon, and

~~such~~ determining that ~~the~~ pixels contained in the intersection are ~~identified and provided~~within a shadow to provide the pixels with color representing the shadow ~~if the pixels are associated with a front-facing shadow polygon in front of one of the normal polygons, and a back-facing shadow polygon in back of another of the normal polygons~~.

Claim 2 (original): The graphic processing apparatus as defined in claim 1, wherein

the Z-buffer memory and the pixel memory have a capacity for one line in one display screen, and

the visual-point coordinate conversion processing section and the hidden surface removal and shadowing processing section process per line.

Claim 3 (original): The graphic processing apparatus as defined in claim 1, wherein

if a plurality of the shadow volumes are present, the hidden surface removal and shadowing processing section performs processing concerning the shadow polygons per shadow volume.

Claim 4 (currently amended): A graphic processing apparatus having a Z-buffer memory storing a Z value representing a depth of a display object when seen from a visual point per pixel and a pixel memory storing color data on each pixel for creating an image of a shadowed three-dimensional object having shadows produced by obstructing a ray of light from a light source by the three-dimensional object, comprising:

a normal polygon conversion section for upon input of graphic data on normal polygons constituting each object including the three-dimensional object, converting the graphic data to visual-point coordinates including x-coordinates and y-coordinates and depth values;

a shadow polygon conversion section for upon input of graphic data on shadow polygons constituting a shadow volume that defines a shadow space produced by obstructing the ray of light from the light source by the three-dimensional object, converting the graphic data to visual-point coordinates including x-coordinates and y-coordinates and depth values, and outputting the visual-point coordinates and the depth values in a state of being sorted into those of front-facing shadow polygons that face front when seen from a visual point and those of back-facing shadow polygons that face back when seen from the visual point;

a normal polygon processing section for performing hidden surface removal processing by Z-buffer method on the normal polygons based on the visual-point coordinates and the depth values of the normal polygons and updating color data and a Z value of each pixel in the pixel memory and the Z-buffer memory based on the processing result;

a back-facing shadow polygon processing section for obtaining a coordinate region positioned in front of the back-facing shadow polygons when seen from the visual point based on the visual-point coordinates and the depth values of the back-facing shadow polygons and on the Z values after the hidden surface removal processing is performed,

wherein processing of the back-facing shadow polygons includes obtaining the depth value of each pixel of the back-facing shadow polygons, ~~comparing~~ and performing a Z test in which the depth value is compared with a corresponding Z value obtained from the Z-buffer memory, and if the depth value is equal to or greater than the corresponding Z value, then the pixel is processed as belonging to a Z-test failed region of the back-facing shadow polygon;

a shadow flag memory for storing a flag value representing a visual-point coordinate positioned in front of the back-facing shadow polygons; and

a front-facing shadow polygon processing section for obtaining a coordinate region positioned behind the front-facing shadow polygons and in front of the back-facing shadow polygons when seen from the visual point based on the visual-point coordinates and the depth values of the front-facing shadow polygons and on the Z values after the hidden surface removal

processing is performed and on the flag value, and for updating color data on pixels in the pixel memory corresponding to the obtained coordinate region to shadow color data,

wherein processing of the front-facing shadow polygons includes obtaining the depth value of each pixel of the front-facing shadow polygons, ~~comparing~~ and performing a Z test in which the depth value is compared with a corresponding Z value obtained from the Z-buffer memory, and if the depth value is smaller than the corresponding Z value, then the pixel is processed as belonging to a Z-test passed region of the front-facing shadow polygon,

obtaining an intersection of the Z-test failed region of the back-facing shadow polygon and the Z-test passed region of the front-facing shadow polygon, and

~~such~~ determining that ~~the~~ pixels contained in the intersection are ~~identified and provided~~within a shadow to provide the pixels with color representing the shadow ~~if the pixels are associated with a front-facing shadow polygon in front of one of the normal polygons, and a back-facing shadow polygon in back of another of the normal polygons~~.

Claim 5 (original): The graphic processing apparatus as defined in claim 4, wherein

the Z-buffer memory, the pixel memory, and the shadow flag memory have a capacity for one line in one display screen, and

the normal polygon conversion section, the shadow polygon conversion section, the normal polygon processing section, the back-facing shadow polygon processing section, and the front-facing shadow polygon processing section process per line.

Claim 6 (original): The graphic processing apparatus as defined in claim 4, wherein

if a plurality of the shadow volumes are present, the back-facing shadow polygon processing section and the front-facing shadow polygon processing section perform processing concerning the shadow polygons per shadow volume.

Claim 7 (original): The graphic processing apparatus as defined in claim 4, wherein

the normal polygon conversion section, the shadow polygon conversion section, the normal polygon processing section, the back-facing shadow polygon processing section, and the front-facing shadow polygon processing section are included in a portable device.

Claim 8 (original): The graphic processing apparatus as defined in claim 7, wherein the portable device is connectable to a communication network, and the graphic data is obtained through communications via the communication network.

Claim 9 (currently amended): A graphic processing method using a Z-buffer memory storing a Z value representing a depth of a display object when seen from a visual point per pixel and a pixel memory storing color data on each pixel for creating an image of a shadowed three-dimensional object having shadows produced by obstructing a ray of light from a light source by the three-dimensional object, comprising:

converting graphic data on normal polygons constituting each object including the three-dimensional object to visual-point coordinates including x-coordinates and y-coordinates and depth values;

converting graphic data on shadow polygons constituting a shadow volume that defines a shadow space produced by obstructing the ray of light from the light source by the three-dimensional object to visual-point coordinates including x-coordinates and y-coordinates and depth values, and sorting the visual-point coordinates and the depth values into those of front-facing shadow polygons that face front when seen from the visual point and those of back-facing shadow polygons that face back when seen from the visual point;

performing hidden surface removal processing by Z-buffer method on the normal polygons based on the visual-point coordinates and the depth values of the normal polygons and updating color data and a Z value of each pixel in the pixel memory and the Z-buffer memory based on the processing result;

obtaining a coordinate region positioned in front of the back-facing shadow polygons when seen from the visual point based on the visual-point coordinates and the depth values of the back-facing shadow polygons and the Z values after the hidden surface removal processing is performed;

obtaining a coordinate region positioned behind the front-facing shadow polygons when seen from the visual point based on the visual-point coordinates and the depth values of the

front-facing shadow polygons and the Z values after the hidden surface removal processing is performed; and

updating color data on pixels in the pixel memory corresponding to a coordinate region positioned behind the front-facing shadow polygons and in front of the back-facing shadow polygons when seen from the visual point to shadow color data,

wherein processing of the back-facing shadow polygons includes obtaining the depth value of each pixel of the back-facing shadow polygons, ~~comparing~~ and performing a Z test in which the depth value is compared with a corresponding Z value obtained from the Z-buffer memory, and if the depth value is equal to or greater than the corresponding Z value, then the pixel is processed as belonging to a Z-test failed region of the back-facing shadow polygon, and

processing of the front-facing shadow polygons includes obtaining the depth value of each pixel of the front-facing shadow polygons, ~~comparing~~ and performing a Z test in which the depth value is compared with a corresponding Z value obtained from the Z-buffer memory, and if the depth value is smaller than the corresponding Z value, then the pixel is processed as belonging to a Z-test passed region of the front-facing shadow polygon,

obtaining an intersection of the Z-test failed region of the back-facing shadow polygon and the Z-test passed region of the front-facing shadow polygon, and

~~such~~ determining that the pixels contained in the intersection are ~~identified and provided~~within a shadow to provide the pixels with color representing the shadow ~~if the pixels are associated with a front-facing shadow polygon in front of one of the normal polygons, and a back-facing shadow polygon in back of another of the normal polygons~~.

Claim 10 (previously presented): The graphic processing apparatus as defined in claim 4 running a graphic processing program causing a computer to function as the normal polygon conversion section, the shadow polygon conversion section, the normal polygon processing section, the back-facing shadow polygon processing section, and the front-facing shadow polygon processing section.

Claim 11 (original): A program storage medium allowing computer to read, characterized in that the graphic processing program as defined in claim 10 is stored.